

Understanding and Predicting Changes in the Ocean Science, Technology and Operations Workforce

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<http://www.marinetech.org/OSTOworkforcestudy>

LONG-TERM GOALS

The goals of this workforce study are to (1) produce a more complete description of the present state of the ocean science, technology, and operations (OSTO) workforce; (2) anticipate future developments and predict the evolution of this workforce; and (3) characterize the educational programs that will be needed to respond to expected workforce changes. Initially, the project will focus on the workforce required to support current and planned ocean observing systems (OOS) efforts; it will then expand to include related sectors of the economy such as telecommunications, hydrographic surveying, the oil and gas industry and others.

OBJECTIVES

Four objectives have been defined to meet the goals of this project:

- (1) Characterize the current workforce which supports ocean observing systems.
- (2) Characterize the current workforce which supports other OSTO arenas which require knowledge and skill sets similar to the OOS occupations.
- (3) Identify the types of information required to monitor the evolution of the OSTO workforce over the next two decades, identify the most probable future workforce scenarios, and design initial workforce prediction systems.
- (4) Identify education and training objectives and practices that effectively address current and anticipated OSTO workforce needs.

APPROACH AND WORK PLAN

1) Proposed approach

To characterize the current workforce supporting ocean observing systems and other OSTO fields, we will gather data from existing workforce studies and collect new workforce information when adequate data does not currently exist. Methods for collecting new information will include: (a) online workforce surveys; (b) focus groups to define occupations in detail; and (c) workshops to provide insight into present and future workforce and educational needs. We will also compare the OSTO workforce to those for similar non-oceanic fields (e.g., space-based Earth observing systems; weather observation, analysis, and forecasting) in order to improve our analysis and prediction of the evolution

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of the OSTO workforce, and assist in identifying effective practices for the education and training of this workforce.

Results gathered from data analyses will be used to identify the most probable scenarios for the evolution of the OSTO workforce, and to recommend methods for monitoring and predicting this evolution on a continuing basis. Drawing from effective practices in industry and related sectors of the economy currently undergoing rapid changes and increasing pressures from globalization, we will also identify the educational practices best suited for supporting this evolution, and propose methods for testing and monitoring the effectiveness of OSTO educational programs. The major deliverable products of this project will be: data and subsequent reports from project surveys, focus groups, and workshops; online databases; project web site with access to surveys, project data and reports; and conference papers and journal articles.

2) Key individuals and roles played

In addition to Ms. Sullivan's role as principal investigator and Dr. Murphree's role as project director, this project includes several co-PIs from various institutions and organizations. All the partners will make substantial contributions to planning and conducting the project, including participation in carrying out the four main project objectives. The following partners will also have additional responsibilities:

- Dr. Lisa Campbell and Texas A&M University will host one or more focus groups to produce knowledge and skills guidelines (KSGs) for specified occupations.
- Dr. Janice McDonnell of Rutgers University and its Institute for Marine and Coastal Studies will host and coordinate the workshop on OOS workforce data collection, analysis, and prediction.
- Dr. Sharon Franks of Scripps Institution of Oceanography and its Center for Earth Observations and Applications and Center for Educational Outreach Connections will host and coordinate the education workshop.
- Mr. Bruce Gilman and Mr. Drew Michel will: (1) develop connections between the project and ocean industries and marine professional societies; (2) recruit industry participants for the surveys, focus groups, and workshops; and (3) provide industry and professional society perspectives on OSTO workforce issues.
- Dr. Murphree and the Naval Postgraduate School will: (1) establish connections with operational military oceanography programs, including research, development, and education programs; and (2) recruit military participants for the surveys, focus groups, and workshops.

3) Work plans for the upcoming year.

During the upcoming calendar year, several tasks pertaining to each of the four project objectives will be accomplished. Additionally, an expanded and updated project website will be available early in the year.

Characterization of the OOS workforce (objective 1) will be completed in its entirety, including design of the online survey process, distribution of pilot survey to refine methods and survey questions, and survey dissemination to 40 or more OOS organizations. Quantitative analyses will be performed to assess how well the data represents the intended respondent groups, calculate basic quantities (e.g., respondent demographics, means, distributions), and determine relationships between variables (e.g., relationships between employee educational background and employer provided education and training, common KSS for different occupations).

A second survey effort will be conducted to characterize the OSTO workforce (objective 2). The OSTO sectors on which we will focus our investigations will include: basic and applied research, oil and gas, hydrographic surveying, national security, ocean forecasting, and resource management. We will analyze existing data available on the OSTO workforce, then conduct surveys of 150 or more employers. Together, the analyses of existing data and the survey results will be used to summarize the number, type, and location of OOS-like occupations, as well as the supply and demand for these occupations. Common occupations between the OOS and OSTO workforces will be identified based on survey results; these occupations will then be characterized through survey of 300 or more employees. The types of data collected and the methods used in the employer and employee surveys will be similar to those for Objective 1. Results of all surveys will again be analyzed and reported.

Assessments of related workforce data collection, analysis, and prediction systems have begun and will continue into the upcoming year; these will be used in conjunction with the aforementioned survey results to conduct an initial identification of the major variables that affect the evolution of the OSTO workforce (objective 3). We will then conduct a workshop with OSTO (especially OOS) employers and employees, and workforce analysis experts from related fields, to: (1) evaluate the results of our data analyses related to workforce prediction; (2) identify relevant lessons from our analyses of other science, technology, and operational workforces; (3) determine the most probable workforce scenarios as OOS evolve over the next 20 years (i.e., create consensus predictions), with clear descriptions of underlying assumptions about critical variables (e.g., economic and technological factors); (4) critique and draw lessons from the results of our investigations into existing workforce monitoring and prediction systems; and (5) produce recommendations for developing an integrated and routine OSTO data collection, monitoring, and prediction system.

Tasks directed toward identifying effective education practices (objective 4) that are scheduled for completion in the upcoming year include: (1) synthesizing the results of prior OSTO education studies with results from objectives 1-3; (2) identifying gaps in the process of educating the OSTO workforce; (3) identifying gaps in the data sets needed to determine the most effective methods for educating the OSTO workforce; and (4) developing hypotheses for effective education of this workforce.

WORK COMPLETED

We did not receive access to our funds until October 26, 2006, so this pushed back the effective start date of the project roughly 4 months. Much of the work completed to date has involved literature reviews, research on existing studies and data sets regarding OOS and OSTO occupations, and making short presentations at national conferences to gain support for the project. Three databases have been formed: (1) a Job Description database to gather pertinent occupation titles, job duties and qualifications; (2) an Employment Opportunities database, which will provide information on current OSTO-related job openings and the businesses and/or organizations hiring for these positions; and (3) a contact list of OOS-related personnel to survey.

Conferences and meetings have been attended to disseminate project information and generate interest in completing surveys. Carmyn Priewe, Workforce Survey Coordinator at the MATE Center, attended Monterey Bay Aquarium Research Institute's Monterey Bay 2006 Visitor Day on August 24. Its purpose was to provide civilian and military leadership insights into the MB06 research experiment and an appreciation of an evolving ocean observing and undersea monitoring capability consisting of a diverse collection of mobile, manned and unmanned observing platforms operated within the context

of data-assimilating models. Carmyn also attended the MTS/IEEE Oceans 06 conference September 18-21. A meeting with Heather Kerkerling, the regional coordinator of the Central and Northern California Ocean Observing System (CeNCOOS), was held November 16 to discuss the workforce project and the working relationship between our organizations. As a result of these conferences and meetings, and with additional input from all project co-PIs, a contact list of 117 potential survey respondents for the OOS and OSTO survey portions of the project has been developed. Additionally, a small “pre-pilot” survey was distributed to several of these contacts, providing us with valuable feedback as we develop and refine survey questions. A presentation on the project was made to the American Geophysical Union (AGU) Ocean Science board on December 11, 2006 and a short presentation was given at the ORION town hall meeting at AGU on December 12, 2006.

A website devoted to the NOPP project is under development, and will contain: (1) project news and information, including survey results and reports; (2) a link to the online survey center; (3) links to events and other websites pertinent to the project; and (4) contact information for project staff.

RESULTS

Due to the relatively recent receipt of funding for this project, there are no significant results or conclusions to report at this time.

IMPACT AND APPLICATIONS

National Security

Ocean science, technology, and operations are vital to National Security and Homeland Defense. A better description of this workforce and the education programs needed to sustain it will help improve the quality of the workforce in support of these areas.

Economic Development

Skilled workforce shortages are already affecting the bottom line of many ocean and non-ocean industries. A detailed study of the OSTO workforce and the educational infrastructure required to support it is long overdue. An in-depth study of the OSTO workforce will contribute not just to the health of the ocean economy, but to the health of our economy as a whole.

Science Education and Communication

This project has the potential to profoundly influence higher education related to ocean science and technology through its efforts to characterize the educational programs that will be needed to respond to expected workforce changes in this field. This project, coupled with efforts of the COSEE centers and the MATE Center, has the potential to reach large audiences of educators in the ocean science and technology field.

TRANSITIONS

Due to the relatively recent receipt of funding for this project, no products or results are yet available.

RELATED PROJECTS

The MATE Center is currently conducting a NOAA-funded project entitled “Professional Certification Program for Oceanographers” with funding granted through June 2008. This project also involves a survey effort, the results of which will be beneficial to our workforce study. In turn, information gathered from the OSTO workforce surveys regarding occupations, and the education and experience required for them, will be useful in determining the need for professional certification. More information on this project may be found at <http://www.marinetech.org/pcpo> .

The MATE Center is in its fifth year of funding as part of Center for Ocean Sciences Education Excellence (COSEE) California, and has developed a user-friendly interactive web site (<http://www.OceanCareers.com>) that describes: (1) the KSS needed to work in ocean-based careers; (2) the educational institutions that help students prepare for these careers; (3) the employers in these careers, and (4) professional societies that support these careers. One of the workforce development problems this project is addressing is the lack of information on the many ocean careers that are not classified by the U.S. Department of Labor.

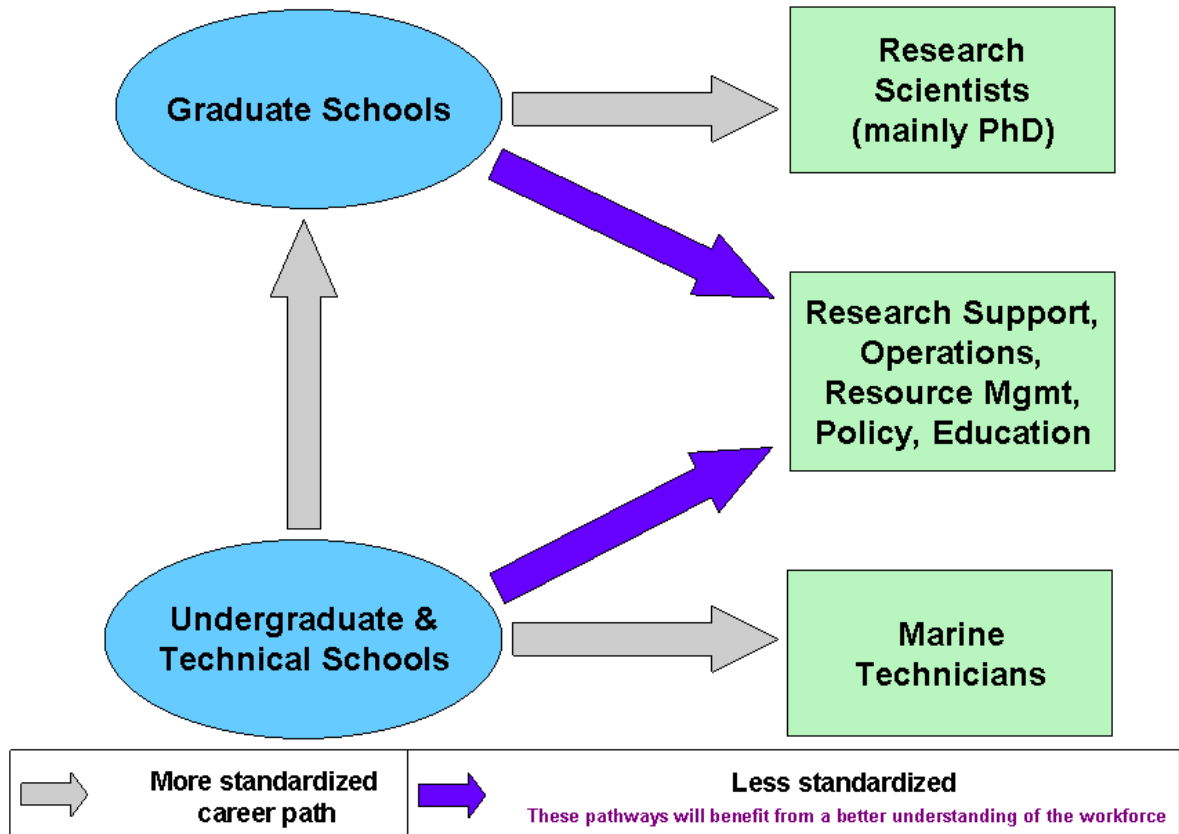
Another related project (awarded to MATE), entitled “Envisioning a National Geospatial Technology Resource Center” and recently funded in part by the National Science Foundation, will develop a vision and plan for a national geospatial technology resource center (NGTRC). This envisioned NGTRC would support college efforts to supply diverse fields (which are enhanced by geospatial technology) with informed, qualified and appropriately-educated technicians by providing broad access to educational resources for workforce development. These efforts will be analogous to our efforts to identify effective practices to educate the OSTO workforce.

Dr. Murphree is currently funded by ONR for a project titled “Meteorological and Oceanographic Metrics.” This project has developed and tested methods for quantitatively and objectively assessing the: (1) performance of meteorological and oceanographic forecasts; and (2) impacts of those forecasts on the planning and operations of the end users of the forecasts.

A COMPELLING FIGURE

Higher Education and Career Paths in Ocean Science and Technology

This diagram illustrates how higher education may change with a better understanding of the ocean workforce



Adaptation of figure by Mel Briscoe